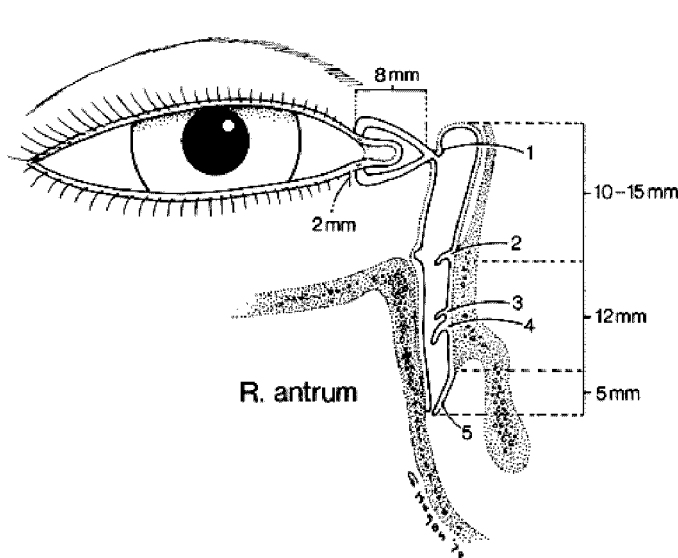


Lacrimal system



Dr/ Mahmoud Medhat

011 300 4 901

*To the only one who gave me **HOPE***

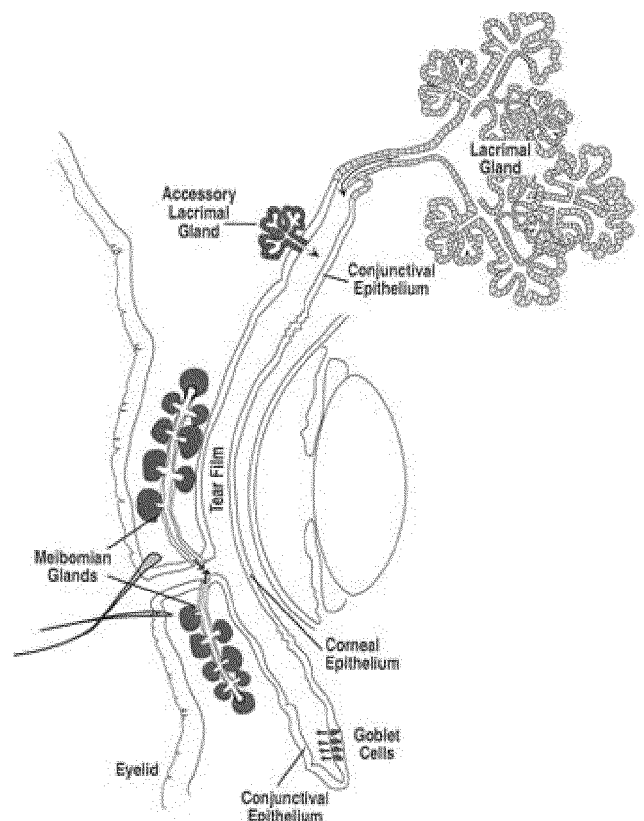
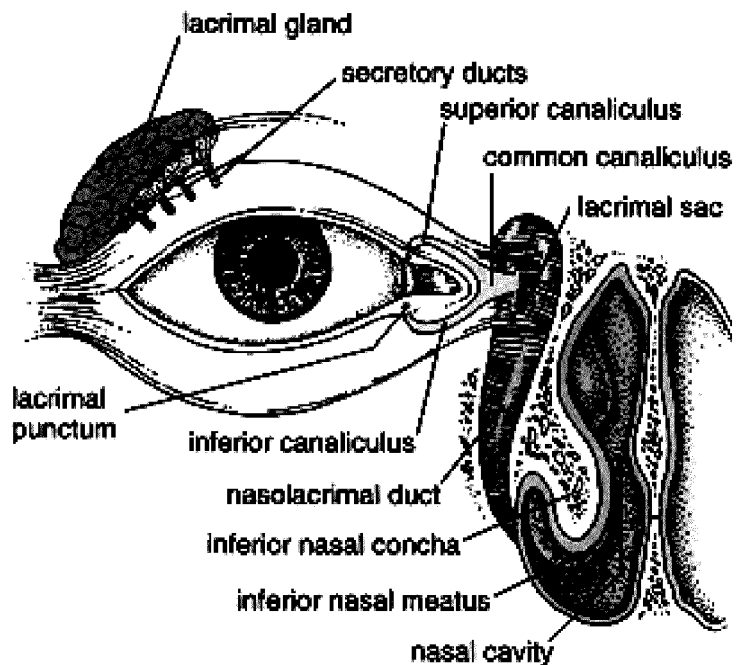
Anatomy of the lacrimal system

1. Secretory part:
 - a. The main lacrimal gland (Orbital & palpebral portions).
 - b. Accessory lacrimal glands (Glands of Krause & glands of Wolfring).
 - c. Conjunctival goblet cells.
2. Excretory part (Drainage system):
 - a. Two puncti.
 - b. Two canaliculi.
 - c. Lacrimal sac.
 - d. Nasolacrimal duct (NLD).

I. Secretory part:

1. The main lacrimal gland: Almond shaped, lying in the lacrimal fossa, at the upper lateral corner of the orbit.

- Divided into:
 - **Orbital portion:** Large.
 - **Palpebral part:** Smaller & resting on the superior conjunctival fornix, so it can be seen on lid eversion.
- It opens by 12 ducts, arising from the orbital part ⇒ passing through the palpebral part ⇒ opening into the superior fornix. (Removal of the palpebral part prevents the secretion from the whole gland).
- **Nerve supply:**
 - Sensory: Lacrimal



branch from the ophthalmic.

- Parasympathetic (Secretory): Facial nerve.
- Sympathetic: The superior cervical ganglion.

2. Accessory lacrimal glands:

- **Glands of Krause:** Microscopic acini in the fornices.
- **Glands of Wolfring:** Opposite the mid-tarsus.

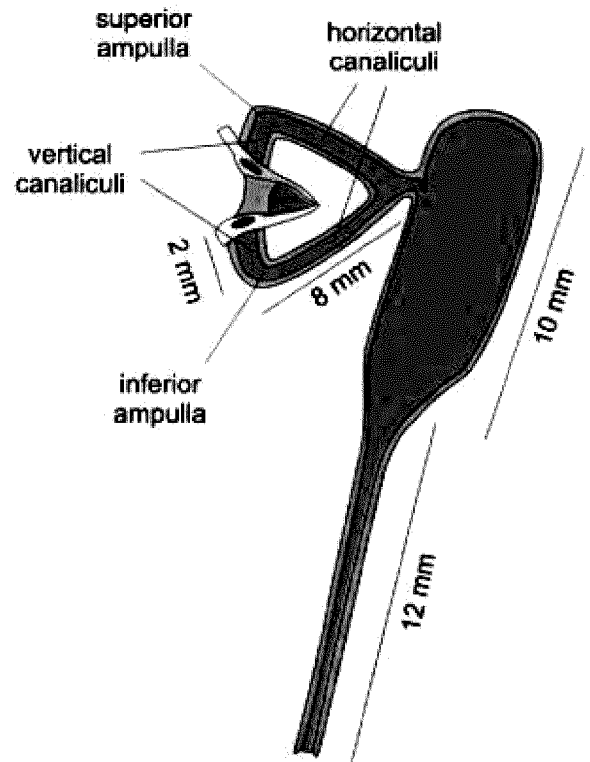
3. Conjunctival goblet cells: Unicellular mucinous glands.

II. Lacrimal drainage system:

1. **Two puncti:** Small orifices situated on the lacrimal papilla, at the posterior edge of the lid margin, 6mm from the medial canthus.

2. Two canaliculi:

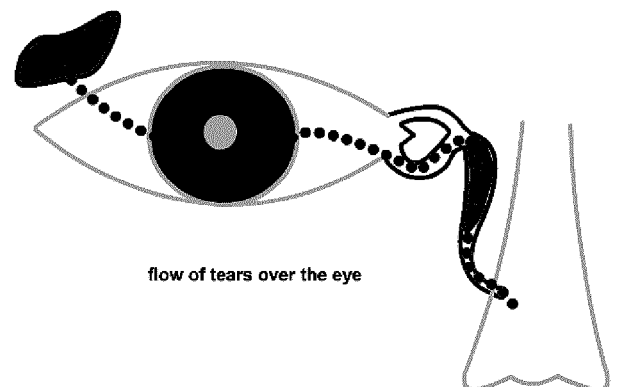
- Fine tubes from the lacrimal puncti to the lacrimal sac.
- They unite forming a common canaliculus (1-2mm).
- Each canaliculus is divided into a vertical (2mm) & a horizontal (6mm) portion.



3. **Lacrimal sac:** In the lacrimal fossa, at the anterior part of the medial orbital wall.

4. Naso-Lacrimal duct (NLD):

- Passing from the lacrimal sac, to open in the inferior meatus of the nose (12-24mm). At that level it is guarded by Hasener's valve ⇒ preventing passage of air or discharge from the nose.
- Direction: Downward, slightly backward & laterally.



Precorneal tear film

Layers of the tear film:

1. Outer lipid layer:

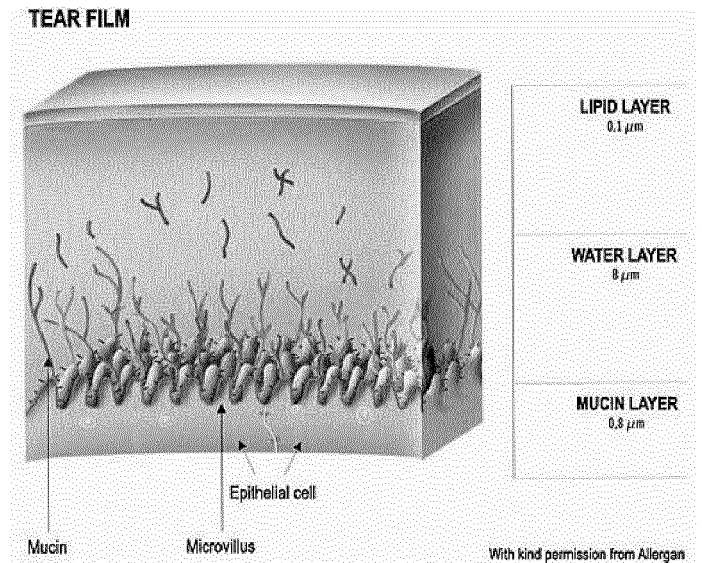
- From meibomian glands.
- ⁽¹⁾Prevents rapid evaporation of tears &
- ⁽²⁾lubricates the eyelid above the globe.

2. Middle aqueous layer:

- From the lacrimal gland.
- Function:
 - Supplies O₂ to the corneal epithelium.
 - Antibacterial (It contains lysozymes & Ig).

3. Inner mucous layer:

- From goblet cells.
- Renders the corneal epithelium hydrophilic.



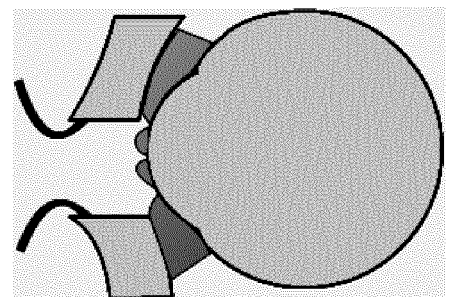
Dry eye

Definition: Lack or even absence of one or more of the 3 layers of the precorneal tear film.

Aetiology

1. Deficiency of the lacrimal layer:

1. Congenital absence of the lacrimal gland.
2. Inflammations of the lacrimal gland.
3. Tumours of the lacrimal gland.
4. Keratoconjunctivitis sicca:
 - Autoimmune atrophy & fibrosis of the lacrimal gland.
 - More in females.
 - Sjogren syndrome: If associated with arthritis & dry mouth.



2. Deficiency of the mucin layer:

1. Avitaminosis A.
2. Conjunctival scarring, due to trachoma, chemical burns, Stevens Jhonson syndrome & ocular cicatricial pemphegoid.

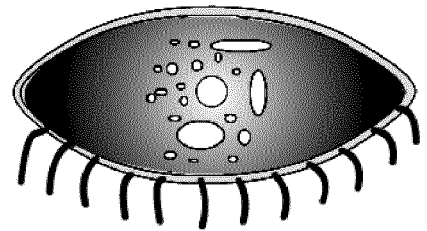
3. Deficiency of the lipid layer: Meibomian Gland Dysfunction.

Symptoms

- Irritation.
- FB sensation.
- Lack of emotional tears & ↓↓ response to irritants.

Signs

- Deficient precorneal tear film.
- Punctate epithelial erosion.
- Mucous filaments attached to the cornea.
- Conjunctival injection, loss of luster & may be bitot's spots.



Investigations

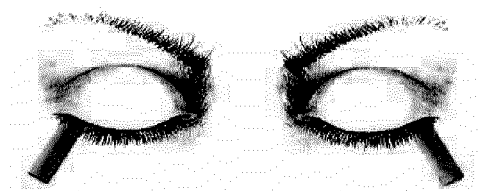
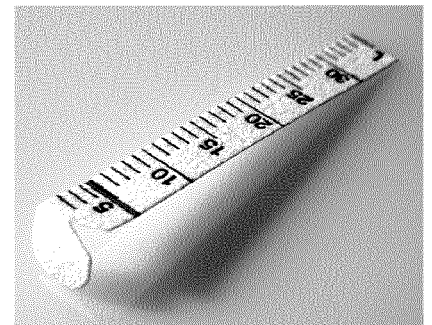
1. **Tear film break up time:** Diminished.
2. **Rose Bengal & fluorescein** staining to demonstrate the degenerated & ulcerated epithelium, respectively.
3. **Conjunctival biopsy:** Showing the pathological changes.
4. **Schirmer's test:**

Measuring the amount of lacrimal gland secretion by measuring the wetting of a special filter paper, inserted into the lateral portion of the inferior fornix.

The filter paper is left for 5 minutes:

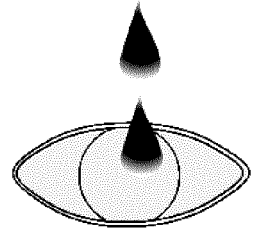
Wetting > 15mm: Normal.

Wetting < 15mm: Dry eye.



Treatment

1. Protective glasses & contact lenses.
2. **Artificial tears**: eye drops &/or ointment.
3. **Punctum occlusion** to reduce drainage.
4. **Systemic steroids** for the associated autoimmune cases.



Watery eye

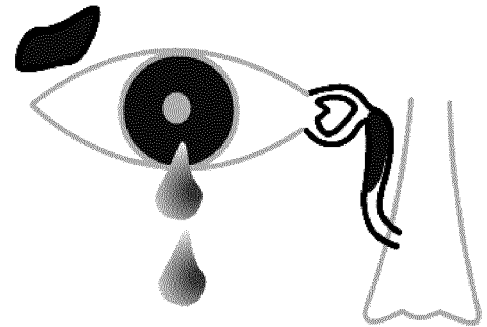
- ❖ **Lacrimation**: Oversecretion of tears, due to:
 1. emotional conditions
 2. **reflex lacrimation**: Foreign body, blepharitis, Keratitis, conjunctivitis, errors of refraction..... etc.
- ❖ **Epiphora**: Overflow of tears over the cheek, due to **inadequate drainage**. It may be due to lacrimal pump failure or obstruction of the lacrimal passages.

Epiphora

Aetiology

1. Lacrimal pump failure:

- Lid margin: Abnormality of the sharp posterior border.
- **Ectropion**.
- Orbicularis muscle: Atony of horner's muscle & **Bell's palsy**.



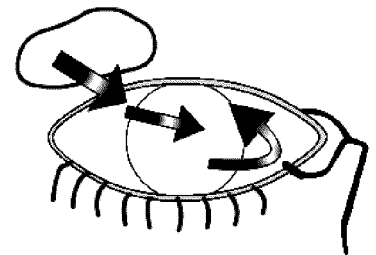
2. Obstructive epiphora:

1. *Puncti*:

- Congenital absence.
- Post-inflammatory scarring: In trachoma.
- Post-traumatic fibrosis.

2. *Canaliculi*:

- Congenital occlusion or stenosis.
- Post-inflammatory & post-traumatic occlusion.



- Fungal canaliculitis.

3. *Lacrimal sac:*

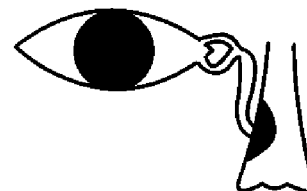
- Congenital absence.
- Dacryocystitis (acute & chronic).
- Fracture orbit.
- Tumours of the lacrimal sac.

4. *Nasolacrimal duct:*

- Congenital imperforation.
- Congestion of the canal veins (50% of cases).
- Fungus in the canal.
- Fracture, periostitis & tumours of the maxillary antrum.

5. *Nose:*

- Adenoids & polyps.
- Deviated nasal septum.
- Hypertrophy of the inferior turbinate.
- Rhinoscleroma.



	Puncti	Canaliculi	Lacrimal sac	NLD
Congenital	Absence	Occlusion or stenosis	Absence	Imperforate
Traumatic	Post-traumatic fibrosis	Post-traumatic occlusion	Fracture orbit	Fracture of the maxillary antrum
Inflammatory	Post-inflammatory scarring e.g. after trachoma	Post-inflammatory occlusion	Dacryocystitis	Periosteitis of the maxillary antrum
Others	FB as a lash	Fungal canaliculitis	Tumours	Congestion

Clinical evaluation & investigations of epiphora

1. **History:** Exclude lacrimation.

Bilateral watering of the eye is usually due to lacrimation, while unilateral watering is usually due to epiphora.

2. **Examination:**

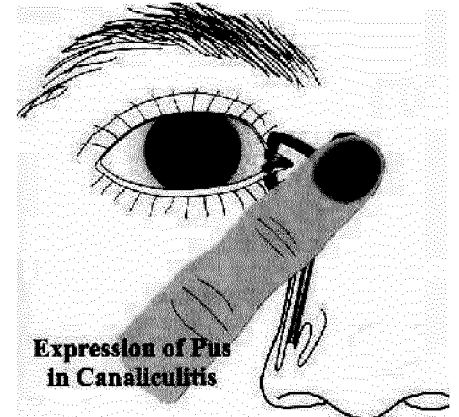
- Eyelids: Exclude trichiasis, ectropion & blepharitis.
- Lacrimal sac: Swelling & dacryocystitis.
- Nose: Polyps & deviated nasal septum.

3. Investigations:

1. Regurgitation test: Positive in cases with NLD obstruction.
2. Jones test.
3. Dacryocystography.
4. Plain X-ray: Diagnosis of tumours & fractures.
5. Tuberculin test for TB.
6. Diagnostic probing & scintillography.

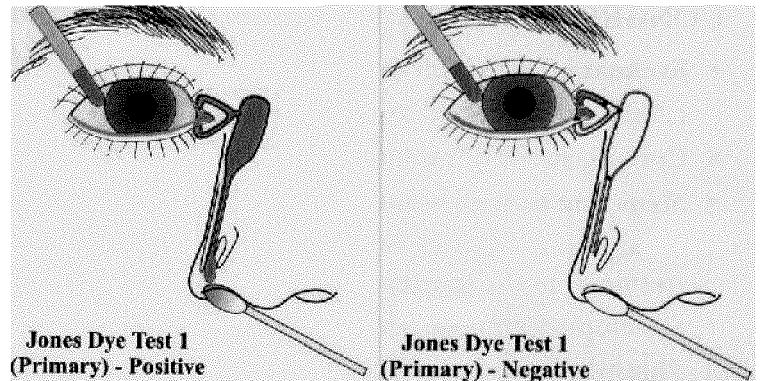
1. **Regurgitation test:** Press on the lacrimal sac against the lacrimal bone:

- +ve regurge: Reflux of pus or tears from the puncti $\Rightarrow$ NLD.
- -ve regurge: No reflux $\Rightarrow$ patent lacrimal passages.



2. Jones test:

- I. **Type I:** Instill a drop of fluorescein in the conjunctival sac & insert a cotton pellet soaked in xylocaine ($\downarrow$ sneezing reflex) under the inferior nasal turbinate.



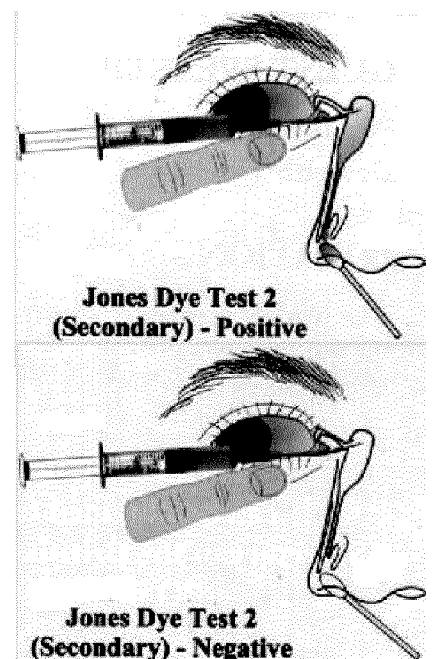
• Results:

1. The cotton is stained with fluorescein $\Rightarrow$ patent lacrimal passages.
2. Not stained: Proceed to Jones test type II.

- II. **Type II:** After type I, irrigate the lacrimal passage with saline.

• Results:

1. If fluorescein is recovered: There is partial or functional obstruction of the passages.



2. If fluorescein is not recovered: There is complete obstruction.

3. Dacryocystography:

Useful for detection of the following:

- ✓ Tumours & calculi appearing as filling defects.
- ✓ Time needed to fill & empty the sac.

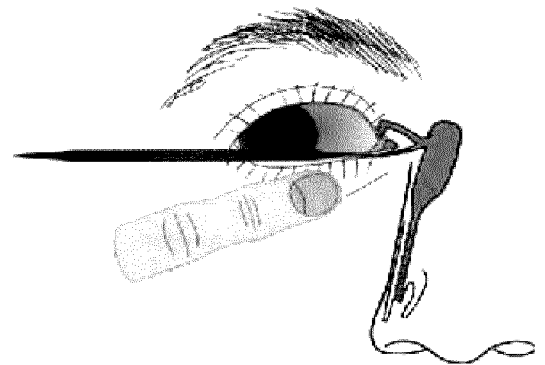
4. Plain X-ray: To detect tumours & fractures.

Treatment

1. Treatment of the cause e.g. ectropion, nasal causes.....etc.

2. Stenosis of the puncti & canaliculi:

- Dilatation & probing.
- Laser punctoplasty.
- One snip ampullotomy: Vertical snip is made in the posterior wall of the canaliculus.



3. Obstruction of the puncti & canaliculi:

Horizontal Path of Dilator

- Three snip ampullotomy: Removing a triangular area of the posterior wall of the canaliculus.
- Dacryocystorhinostomy.

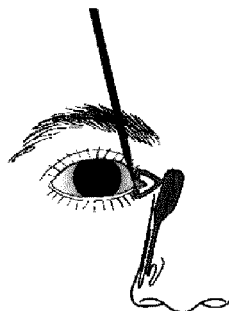
4. Nasolacrimal duct obstruction:

1. Congenital obstruction:

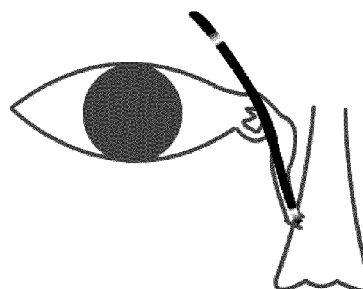
- Hydrostatic massage.
- Dilatation & probing.
- DCR.

2. Acquired obstruction:

- Dilatation & probing: fail.
- DCR.
- Dacryocystectomy



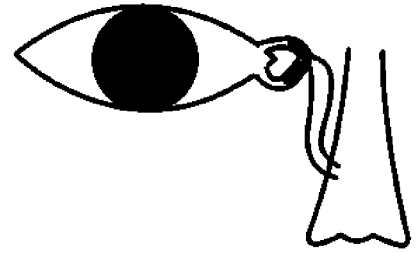
Vertical Insertion of Dilator



Canaliculitis

Definition: Inflammation of the lacrimal canaliculi with ⁽¹⁾pyogenic organism, ⁽²⁾trachoma, ⁽³⁾specific organism or ⁽⁴⁾fungus.

Commonest cause is mycotic canaliculitis, caused by actinomyces Israeli.



Symptoms: Persistent epiphora, not responding to treatment.

Signs:

- Chronic conjunctivitis, most marked at the medial canthus.
- Prominent & dilated lacrimal punctum (Patulous).
- Regurgitation test: Muco-purulent discharge which may contain concretions.

Treatment:

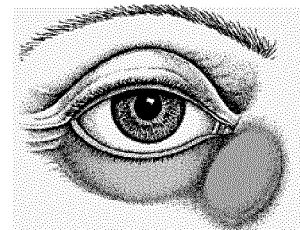
Canaliculotomy: Slit the posterior wall of the canaliculus, curettage of the fungal masses & irrigation with saline.

Inflammations of the lacrimal sac (Dacryocystitis)

1. Adult dacryocystitis:
 - Acute dacryocystitis.
 - Chronic dacryocystitis.
2. Infantile dacryocystitis (Congenital NLD obstruction).

Acute dacryocystitis

Definition: Acute suppurative inflammation of the lacrimal sac.



Etiology

Predisposing factors:

- Nasolacrimal duct obstruction
- Chronic dacryocystitis.

Causative agent:

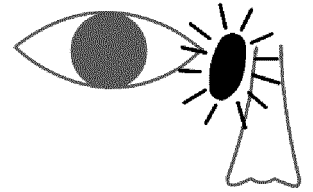
- Pneumococci
- Staphylococci
- Streptococci.

Symptoms

1. Severe pain.
2. Fever.
3. Epiphora.

Signs

1. Tender swelling of the lacrimal sac.



2. Marked **edema** & redness of the skin over the sac.
3. **Regurgitation test:** Reflux of pus, unless pericystitis occurs.
4. **Abscess** formation with fluctuation.

Complications

1. Lacrimal **fistula**: Anterior bursting of the sac through the skin.
2. **Pyocele**: Obstruction of the canaliculi $\Rightarrow$ distension of the sac with pus.
3. **Orbital cellulites**: *Ending in optic nerve atrophy $\Rightarrow$ blindness.*
4. **Cavernous sinus thrombosis (CST)**.
5. **Chronic dacryocystitis**.

Treatment

1. During the acute phase:
 - Systemic & topical **antibiotics**.
 - Hot fomentations.
 - **Lotions**: To clear pus.
 - Incision & drainage: If an abscess forms.

2. After subsidence of the acute attack:

Dacryocystorhinostomy (DCR) +/- fistulectomy.

Chronic dacryocystitis

Definition: Chronic inflammation of the lacrimal sac secondary to obstruction of the nasolacrimal duct. This is the commonest lacrimal sac disorder.

Etiology

Predisposing factors:

- Nasolacrimal duct obstruction.
- Acute dacryocystitis.

Causative agent:

- Pneumococci: 80% of cases.
- Staph, Strept, Trachoma & Fungi.
- TB & Syphilis: Rare.

Symptoms

1. Watery eye.
2. Discharge.

Signs

1. **Red & hyperaemic** inner canthus.
2. **Swelling** of the lacrimal sac: Below the medial palpebral ligament.
3. +ve regurgitation test: Regurgitation of mucous or pus. It becomes -ve on formation of a mucocele.

Complications

1. Chronic conjunctivitis.
2. Vicious circle of epiphora, eczema & ectropion.
3. **Hypopyon ulcer.**
4. **Endophthalmitis:** Following an intraocular operation.
5. **Mucocele & pyocele:** If the canaliculi are obstructed.
6. **Acute dacryocystitis,** abscess & lacrimal fistula.

Investigations: The same as epiphora.

Treatment

Aim:

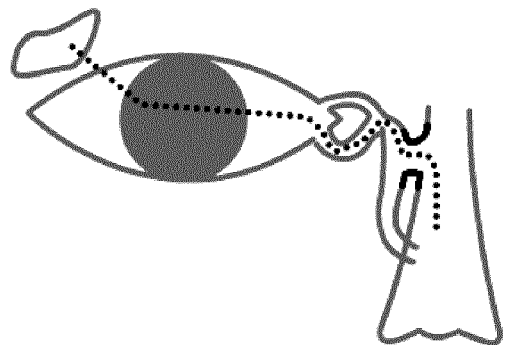
1. Restore communication between the lacrimal sac & the nose.
2. Treatment of infection.

Lines:

1. Treatment of the cause of obstruction.
2. **Dacryocystorhinostomy:**

Principle: Connecting the lacrimal sac to the nasal mucosa ⇒ bypassing the obstructed NLD.

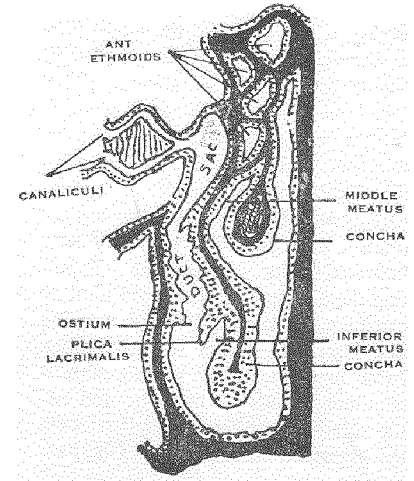
Indications:



- Chronic dacryocystitis.
- Mucocele of the lacrimal sac.
- Lacrimal fistula (+ fistulectomy).

Contraindications:

- Extensive adhesions & neglected cases.
- Nasal pathology e.g. atrophic rhinitis.
- T.B. & lacrimal sac tumours.
- Hypopyon ulcer.



3. Dacryocystectomy:

Principle: Removal of the lacrimal sac.

Indications: Neglected cases, when DCR is contraindicated.

Congenital NLD obstruction (Infantile dacryocystitis)

Etiology: Imperforate hasener's valve (Most common).

Symptoms: Epiphora, 2-3 weeks after birth, is reported by the mother.

Signs

1. Regurgitation test ⇨ clear fluid, mucous or frank pus.
2. Recurrent conjunctivitis.

Treatment

1. **Hydrostatic massage:** Instruct the mother to press on the lacrimal sac in a downwards direction. This may help removing any epithelial remnants & opening hasener's valve.
2. **Antibiotics.**
3. **Probing:** Of great success rate.
4. **Repeated syringing & irrigation.**
5. **Intubation** of the lacrimal drainage system (Silicone tube).
6. **Dacryocystorhinostomy (DCR).**